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With the Compliments of

WM. BLASIUS.

*Von Maria für Naturwissenschaft*

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**I**N WHICH DIRECTION SHOULD CITIES IN  
OUR LATITUDE EXTEND IN ORDER TO  
SECURE TO THEIR POPULATIONS PURE  
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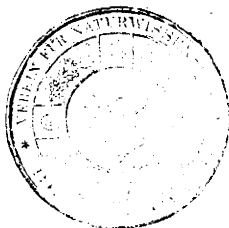


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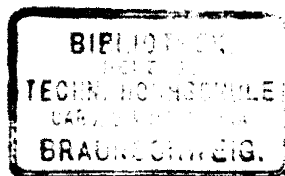
Read before the American Philosophical Society of Philadelphia, 1884,  
By PROF. WM. BLASIUS.

Some one very fitly characterizes the anxiety recently exhibited in the populations of the larger cities, to introduce the Elevated Rail Road for rapid transit as an Elevated Rail Road fever.

A physician sees in a fever the symptoms of a disease, and the nature of them indicates to him the remedy he has to apply to cure it. The disease of which the Elevated Rail Road fever is a symptom, is caused by the want of pure air, which increases in geometrical proportions as the cities grow in size, and the remedy that can cure this growing disease, is the Elevated Rail Road.

Men are as dependent upon the air, as fish are dependent upon the water. We live in the air and in some sense of it. If the air be taken away from us, we would drop dead at once; the same as the fish will die if we take it out of the water. Poisonous substances in the air we breathe, are as dangerous to our health as those mixed with the food or drinks we take. We eat only three times a day, we drink probably six times, we drink or rather breathe air from fifteen to twenty times every minute. Thus we inhale eighteen cubic feet of air every hour or four hundred and thirty-two cubic feet every day.

When an architect builds a house, he selects good material. In building up our body, every careful person avoids using decayed or poisonous substances; but the enormous quantity of air is consumed almost unconsciously; at least we pay little attention to its quality, such as we would naturally pay to the purity of the substances we drink or eat; and yet this is a matter of as great, if not greater importance to our health and life. Mr. Ludlow, Chief Engineer of the Philadelphia Water Department, having received numerous complaints about the impurity of the water during the time the Schuylkill was frozen over, suspected the cause to be that



the sediment in the river generated gases which were prevented from escaping to the air by the covering of ice, thus imparting the unpleasant taste. He placed the subject in the hands of his consulting chemist, Dr. Leeds, whose experiments sustained his opinion. Dr. Leeds further concludes, that the Kensington supply should be abandoned, and believes that disturbing agencies render the lower Schuylkill not potable, and that the supply must hereafter be abandoned, unless some natural purifying agency can be supplemented by artificial means. During the hot season, the chemical action is most powerful, and the products that make the water unpotable escape into the air, causing as great danger to our health as in the water; yet little attention has been paid to this mode of poisoning. The indifference exhibited generally in regard to the quality of air we breathe, is doubtless caused by the fact that the air is transparent, and impurities in it are undetectable to our senses. Modern sciences have however, come to our assistance and shown matter in this apparently pure air, that most people would not even dream of. Chemists find that 100 parts of pure air everywhere, consist of a mixture of 21 parts of Oxygen, 79 parts of Nitrogen, and variable quantity of water in an invisible vapoury state. The two first elements are everywhere constant, the third, the water changes.

It is however, as essential to our health as Oxygen. The dread of many people of moist air is unfounded. If it were injurious, how is it that the English who live in an almost continuous fog, are one of the healthiest nations upon earth. Nature generally regulates the amount of moisture suitable to our health at various degrees of temperature, by condensing and discharging the same in the form of rain or snow. And if in certain localities, by evaporation, more moisture exists, it will soon be removed by air currents passing by. The petition addressed to the City Council a few years ago, by the citizens in the vicinity of Rittenhouse Square, for the removal of the fountains, was not only unnecessary, but unwise. The little amount of moisture that possibly could form by the evaporation of the falling drops, is carried away with the prevailing South-west current as fast as it generates, and could anyhow not effect any increased moisture on the South, West, and East sides of the Square. The dread of Malarial fevers from this source was unnecessary and unfounded.

There is more suffering caused by a want of moisture than can possibly come from an excess of it. The measure was unwise,

because the waste water from these two fountains cleansed the sewers in the neighborhood.

Besides these three constituents in the air essential to our health, the chemists find in the air above certain localities, gases that are deadly poisons, such as carbonic acid gas, sulphuretted hydrogen gas and others.

Those who had the pleasure of listening to the highly interesting and instructive lecture of Professor Dr. J. Leidy, on the "Lowest forms of animal and vegetable life" recently, must have been surprised, if not horrified by the facts that myriads of microscopic monsters of many different kinds fill the air and are swallowed by us by thousands in breathing. I say that they must have become horrified to learn that these minute beings, although they are so small that with the aid of the most powerful microscope they scarcely can be seen, they nevertheless have been traced as the probable cause of the most dreadful diseases, such as Malarial Fever, Diphtheria, Scarlet Fever, Croup, Smallpox, Consumption, etc., etc. The German Commission sent to Egypt and India to investigate the cause of Cholera, found the seed of this fearful disease also in one of these lowest of living beings.

If we take further into consideration that these small beings multiply themselves to millions in one hour, that their principal breeding places are in marshes and swamps, *i. e.*, stagnant water where animal and vegetable life is decaying; that no swamp can be worse than the ground on which a thickly populated city has been built; that here underneath the pavements, in gutters, yards, alleys, cesspools, and last but not least in the narrow sewers, where without air or light, the most noxious gases are being generated, and a life most deadly to us is being created. When we learn that Professor Leidy procured some of his specimens even in front of his house between the bricks of the footwalk, we can readily understand why the want of pure air makes people feverish for rapid transit, so that they can breathe air purified by the growing plants in the country.

During the first few years of Philadelphia's existence, there was plenty of pure air, and all business transactions could be performed without any public conveyances. As it grew larger, the private dwellings were placed on the outskirts and omnibuses became necessary. Some years later the omnibus system had to give way to the street cars for the same reason. In this age of electricity when six minutes are worth more than six hours, fifty

years ago, rapid transit became a necessity, if for no other reason than as a sanitary measure. Rapid transit will bring, so to say, the country to the city, and give to the greater portion of its population pure air, and take them in a direction that is the nearest to the business localities, and at the same time the healthiest.

Those who might fail to put all the confidence in the results of Professor Dr. Leidy's investigation, which his high standing in the scientific world has a right to demand, on account of his having been born and educated in Philadelphia, may probably be more satisfied by reading the works of Pasteur in Paris, Koch in Berlin, and others who arrived at similar results. If the testimony of these most able scientists should not convince one of the above facts, he may satisfy himself by his own eyes by making a simple experiment that has been proposed by Tindale in London.

On a day when the sun shines brightly, close the shutters of your room and observe the path a sunbeam takes that enters the darkened atmosphere, through a crevice or little hole in the shutters, and you will see myriads of little objects dancing and twisting in it. These little objects almost invisible by the most powerful microscope, are nevertheless revealed here to the eyes by the reflex of the sun's rays; and they consist of fragments of cotton, fibres of flax, wool, wood, etc., the greatest abundance of fungoid matter, spores, sporidia, etc.; many of these are living and develop forms resembling rust and mildew.

It has been calculated that a full grown man in a thickly populated city like Manchester, England, inhales in ten hours, thirty-seven and one-half millions of such spores.

If the generation of gases and the lowest forms of animal and vegetable life are going on in localities deprived of light and oxygen, as is the case in the narrow unventilated sewers underneath the cities, they must be of a still more dangerous character.

If our present City Council had witnessed what I saw a few years ago, at Nineteenth and Chestnut Streets, and which I learn is not an infrequent occurrence, where one morning the generated gases, probably mixed with light gas, exploded, and threw the culvert and its filthy contents to the surface, they would not only see the necessity of granting the privilege to build an Elevated Rail Road, but would gladly assist in buying the streets through which it should go, in order to procure to the citizens an opportunity to spread over the country and enjoy the benefit of pure air. The City bought thousands of acres of land to establish the large

and beautiful Park, which is Philadelphia's pride. While the Park affords pleasant drives for the wealthy, the great mass of the population, the professional, mercantile and laboring classes, derive very little or no benefit from it, because they can at best, reach it only on Sundays for a few hours. Three-fourths of the population are forced by circumstances to live between and above these death brewing laboratories, the products of which are carried even to the sleeping apartments, by the way of the waste pipes, for a force capable of casting up the sewer and the pavements above it, will not be kept back by the little quantity of water in the so-called safety traps. Considered from this standpoint, not only the 27th and 24th Wards, but the population of the whole city; even those who now oppose the Elevated Rail Road project, will see its benefit as a sanitary measure.

Anyone who considers the above facts in the light of common sense, must come to the conclusion that the natural swamps and much less, the artificial swamps underneath thickly populated cities, are no desirable places to live on.

The question then arises: What is a healthy site for a house? The laws of nature that regulate the sanitary condition of a place are very imperfectly understood and very seldom applied rightly. Most people are guided or rather misguided by that erroneous notion, that high ground is all that is required to assure health. If a house stands a few feet higher than another, it is considered healthier. The inhabitants of the northern portion of our city for instance, consider themselves above and out of the reach of the dangerous influences of the miasma generated in the marshes of the lower Schuylkill and Delaware, and the lower and older portion of the city, and yet the difference in elevation is not more than the height of a medium house. The prevailing notion that high ground is more healthy than low ground, is bare of any sound reason; indeed, if we were to reverse the sentence and maintain that low ground is more healthy than high ground, we can sustain it with as many, if not more sound reasons. Wiesbaden, one of the most reputed resorts for health on the continent of Europe, is on low ground surrounded by mountains on the West, North and East. Numerous instances of this kind could be pointed out in this and in other countries, showing that the elevation as such, has little to do with the health of a place. Indeed, high ground may become very dangerous to certain constitutions as it exposes us during the cold season to the cold north wind. The idea that

high ground is healthier than low ground must have originated with the erroneous presumption, that swamps and low ground are necessarily found together. The formation of swamps depends however more upon the geological condition than upon the elevation. We find stagnant water or swamps upon the highest mountains and on the other hand, perfectly dry land in the lowest valleys. Those who remember the time when brick yards were in operation on the ground on which now the northern portion of the city has been built up, must remember also, the numerous ponds of stagnant water, capable of generating miasma, no matter what the elevation may be.

More than the nature of the ground, the prevailing air current during the hot season, and the relative position a house has toward a miasma breeding locality, are deciding its sanitary condition. Most people seem to think that the air above a miasma breeding locality stays where it is, that they need only go away from it no matter in what direction, in order to avoid its fatal influence. We know now from Meteorology, that the air is in constant motion and moves according to definite laws. In the temperate zone, the prevailing direction of the air movement during the hot season, when miasma principally are generated, is from a southerly direction, generally from the Southwest. During the cold season, the prevailing direction is from a northerly point, principally from the Northwest. As the generation of the impurities that fill the air above swamps and thickly populated cities, is most active during the hot season: the position a house has in relation to such places and the direction of the prevailing air current are by far more important than its elevation. If a house stands on the side from where the prevailing air current is coming, its location is free from the miasma and healthy in consequence, however close it may be to the swamp. If it is on that side where the air current is going to, *i. e.*, on the north or east side; no elevation, however high, will protect it from this air current that brings the impurities, taken up from above the miasma breeding locality to the top of the highest mountain. A current of air that rises up and over the crest of the Rocky Mountains, will not stop before an elevation of a few hundred feet.

This explains why many years ago, immediately after the damming of the Schuylkill at Fairmount, the mansions on the east side of that river, although on high ground, were rendered uninhabitable and abandoned on account of Malarial fevers, whilst



those on the west side did not suffer from it. When some years ago, in a paper read before the Philosophical Society, I set forth these views; General Thayer, the Superintendent of the Park, corroborated them from his own experience. A family living north of a marshy creek that runs north of Philadelphia, were during the whole season, subjected to malarial fever, whilst his father's family, living south of the same creek, did not suffer from it at all.

About a year ago, the citizens of Camden made complaint of the disagreeable odor from the oil refineries in the lower portion of Philadelphia. This smell is carried over the Delaware with the prevailing air current. The miasmatic impurities taken up by the same current as it passes over the lower portion of Philadelphia and the Delaware to the north and east the Camden people cannot smell nor see, but they contribute probably more to the frequent fevers in that neighborhood than the low ground.

Animals by instinct, conform themselves to the laws of nature. The prairie dogs for instance, extend their habitations toward the west, the last one building west from the preceeding one. Men sometimes are led astray by social, commercial or other circumstances, but as a general rule the cities in the temperate zone extend to the west; the dwellings of the wealthiest class, being in the advance. The West End of London, known as the aristocratic portion of the city, is an example of it. Philadelphia for many years developed and extended on the same principle, its main streets from the Delaware toward the west; the dwelling houses of the wealthiest being always in advance, the stores following. The force of this law is so strong, that no halt was made on account of the approach of the marshy ground of the Schuylkill and the most beautiful residences were clustered together in the most unenviable position in relation to that river. The Almshouse on the west side, lies in a much more favorable position in regard to health. The want of bridges stopped the natural development of the city toward the west, and it then extended very rapidly toward the north. The managers of the Street Railway Companies, running north and south with great liberality and keen eyes for business, assisted in this unnatural extension of the city toward the north by providing the necessary means of transit.

Whenever at a distance from the terminus of the railroad, a house was built, the managers had immediately a one horse car run between it and the main line, and the result of this liberality

was that in less than six months, many squares of houses rose up and were right away taken possession of by the many who are longing for pure air in the outskirts of the city. The railroads increased thereby the number of their passengers to such a degree, that now they are unable to accommodate them by this way of conveyance. The people of the northern portion of this city have to wait for half hours during business time, on street corners in order to get even a standing place on the cars, although they come close one after another. The worst however, is that these people do not get what they are hoping for; instead of pure air they have to breathe during the hot season, the air of the prevailing current, charged with the impurities taken up as it passes over the swamps of the Schuylkill and the portion of the city south of them. The further they go to the north, the more sources of impurities are left to the south of them, from which the products are brought to them by the prevailing air current. If Philadelphia had not been deterred from its natural course to the west by a want of bridges, the prevailing air current coming from the agricultural part of the country, would furnish its whole population with purified air. As it is now, we get the poisoned air. When London arrived in its development at the River Thames, the people connected the streets with the opposite sides by bridges, and continued the city toward the west. The Parisians in this way also bridged the Seine. New York and Philadelphia developed toward the north contrary to that natural law, upon which the health of a city is greatly dependent. The breadth of the two rivers between which New York is situated, does not allow a system of bridges and thus New York is forced to extend in a northerly direction, that must grow more fatal to its sanitary condition as the city grows older. If the papers report the truth, New York already pays the penalty that the transgression of a natural law always brings with it. According to their statements, there was a time when croup, diphtheria, and similar diseases were unknown there; now they say these diseases have become epidemics. Philadelphia is in no need to follow the fatal course of New York. The Schuylkill is not broad, it can easily be provided with bridges opposite all the main streets. But whilst we have two splendid bridges giving access to the Park, and a third one in contemplation, we have only three miserably constructed concerns, (not one of which is safe to walk over), to connect the main streets with the west side of the Schuylkill, and allow the city to develope in a healthy direction.

Another impediment in the natural and therefore healthy development of Philadelphia has been the want of any transit, we will not say rapid transit, to the west. The former managers of the Chestnut and Walnut Street Passenger Railway Company, who had the monopoly of this business on the west side of the Schuylkill in that direction, being endowed by nature with the opposite qualities of those at the head of the lines running north and south, have been asleep at Forty second and Chestnut Streets for the last twenty years. The short sighted policy of that Company not to accommodate those willing to settle in the right direction has built up so to say, a Chinese wall at Forty-second Street. West of Forty-second Street, between Darby Road and Chestnut Street, we find a tract of land naturally destined to be the site of the dwelling houses of the city; the nature of the soil admirably adapted to build on, its position towards the prevailing air current the most favorable to insure for all future time pure air, the ground undulating and therefore favorable for a natural healthy drainage, which it has into the Mill Creek sewer, nearer to the business centre of the city than the greater portion of the city lying northward; yet in spite of all these advantages, this tract of country land is the least known and therefore the most neglected of the suburbs of the city. Ignorance of the laws that govern the health of a locality, amongst the public generally, prejudice and the absolute want of adequate means of transit have kept this most beautiful and picturesque country, this most healthy part of the city, in an unimproved condition to the detriment of the population of Philadelphia. It is true the streets are paved and equipped with water and gas pipes for many miles ahead, but cows and sheep are still grazing around them as they did twenty years ago. They enjoy the healthy pure air, whilst the people on the east side of the Schuylkill, have to breathe the impurities emanating and carried with the prevailing current, from the swamps and southern portion of the city.

For the reasons set forth above, Philadelphia is bound to overcome these small obstacles and extend itself toward the west. The surface passenger or Elevated Rail Road managers and the builders of houses who are the main factors in the development of cities, will find it in their interest to give the facts set forth above, a careful consideration.

**RULES** for the selection of a healthy site for a house ; deduced from the above.

*First.*—Select soil which permits the water to permeate and avoid clay ground.

*Second.*—Select undulating ground, which makes good drainage possible.

*Third.*—In the neighborhood of miasma breeding places, such as swamps, marshes and thickly populated cities, place your house to the west or south-west of those localities, which will insure safety from their influences, as miasma does not diffuse itself over the entire neighborhood where it is generated, but passes with the air current in the same way as smoke may be seen coming from a chimney.

This will make cities grow to the west in a healthy direction. The prevailing air current will pass over such a built up city from its broad side, and furnish the whole population with pure air from the country.

If the city is built to the north, the prevailing current passes over its entire length, and will furnish the whole population with the impurities generated in the lower parts of the city, accumulating poisons as it advances.

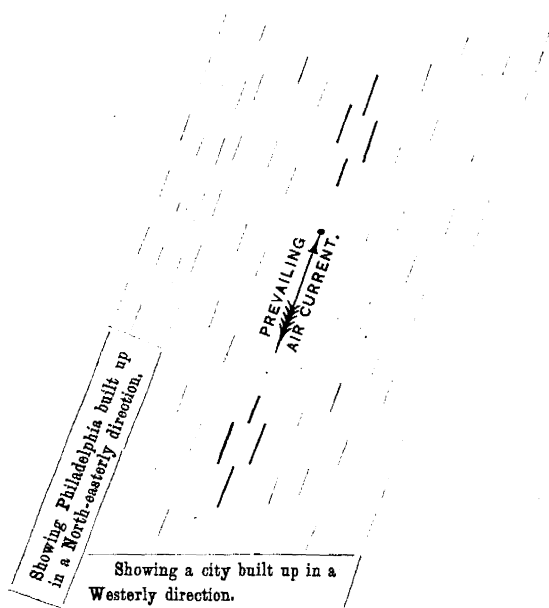


Diagram showing the amount of pure air received by a city, in accordance with the direction in which it is built.



